

Meta-techniques for a Social Awareness Learning Game

Jeroen Linssen, Mariët Theune

Department of Human Media Interaction, University of Twente, Enschede, the Netherlands

j.m.linssen@utwente.nl

m.theune@utwente.nl

Abstract:

In live action role play, so-called meta-techniques are used, in which meta-information (information outside of the enacted world setting, such as learning goals) is taken into account and used during play. We show how we intend to include two such meta-techniques in LOITER, a serious game about social interaction. In this game, players can interact with virtual characters with the ultimate goal of improving their own social awareness. We have constructed sets of learning goals around the interpersonal circumplex, a model for social interaction also used in the training curriculum of the police academy. The meta-techniques we are developing can assist players in attaining these learning goals by providing both feedback and insight into what is at play in characters' minds. The first meta-technique is that of act breaks: intermissions between acts of a live action role play during which players discuss the previous and following acts. In LOITER, consecutive acts have increasing levels of interaction complexity, corresponding to our sets of learning goals. In the act breaks, the trainee and the virtual character exchange information about their motivations for certain actions and what the effects of these actions were. This helps the trainees analyse the situation and their own actions. Secondly, feedback on the actions of trainees can be given in a less intrusive way during the acts themselves. We show, based on another meta-technique, how virtual characters can show 'thought bubbles' which give insight in their personal thoughts and thus help the trainees determine the reasons behind their behaviour.

Keywords: serious game, learning goals, feedback, reflection, social awareness, law enforcement

1. Introduction

Serious (or educational) games focus on providing the means to gain knowledge or practice skills that can also be used outside of the game world. In this paper, we describe the development of game mechanics that will provide feedback to players of a serious game called *LOITER* (LOitering Teenagers, an Emergent Role-play).

For the design of LOITER, we take inspiration from improvisational theatre and (educational) role play. During interaction with trainees, actors can improvise their behaviour to create a certain situation with which the trainees have to learn to cope. In other words, the actors can adapt their behaviour to suit a learning goal. In live action role play, so-called *meta-techniques* may be used, in which meta-information (information outside of the enacted world setting, such as learning goals) is taken into account and used during play. An example meta-technique is that of *act breaks*: intermissions between acts of a play during which players discuss the previous and following acts. We plan to implement such meta-techniques in LOITER to help players attain learning goals revolving around social interaction.

The target group of LOITER is police officers involved in street interventions: they have to talk with civilians and try to resolve possible conflicts in a peaceful manner. Officers are confronted with people with different backgrounds and attitudes and have to adjust their behaviour to the type of person in front of them. During their training curriculum, only a limited number of police trainees are able to practice their interaction skills with training actors. The goal of LOITER is to replicate this setting by letting trainees interact and negotiate with virtual characters who behave as if they were loitering juveniles. Through interaction with these virtual characters, trainees are able to experience how their behaviour influences that of other people, thereby improving their social awareness.

In the next section, we address work on various ways of providing feedback in serious games. We follow this with a discussion of the origins of the approach we take in the design of our serious game together with an in-depth exploration of meta-techniques (Section 3). In Section 4, we address the theory on which we base interaction in LOITER and outline the learning goals we created for the game. In Section 5, we describe how we plan to implement various meta-techniques in LOITER. Finally, in Section 6 we wrap up our thoughts about meta-techniques and provide our outlook on future work.

2. Related work

The field of games-based learning has seen a large body of work devoted to the relation between game mechanics and learning goals (Arnab et al., 2014; van Staalduinen & de Freitas, 2011; Wilson, Bedwell, & Lazzara, 2009). A subset of this research concentrates on the provision of feedback. Work by Traum et al. (2005) focused on the military domain, creating tactical simulations for negotiation with virtual characters. In this domain, the *debrief* phase is of vital importance to having a good review of the events that occurred. Therefore, Traum et al. implemented an interface that showed, after a scenario was played, an overview of the actions taken by both the player and the virtual characters. What distinguished their approach from a mere temporal list of actions is that the player's actions were annotated with how they influenced the trust, belief and strategy choice of the virtual characters. Thus, the player was able to determine, to a limited degree, what changed in the characters' mental models.

Other learning environments, such as *DynaLearn* (Wißner et al., 2012), include virtual learning companions that function as tutors. DynaLearn's cast of companions comprises agents with different feedback styles, such as a 'Mechanic' that gives feedback related to the model a user is building; a 'Quizmaster' that evaluates users by letting them take intermediate quizzes; and a 'Teacher' who gives feedback on the directly visible part of the interface and actions the user takes. An evaluation of this system indicated that users actively interacted with the different learning companions and felt that this contributed to their learning process. Molnar and Kostova (2013) take a similar approach to evaluating players and providing feedback, but integrate their learning companions directly in the story of their *Global Handwashing Day* game (GHD). In GHD, players have to discover whether a famous actor was poisoned or not by investigating the virtual environment and talking to virtual characters. Some of these characters function as tutors, but in a way so that the evaluation is "seamlessly integrated" (Molnar & Kostova, 2013: 1) in the game flow. Results of an experiment in which people played GHD indicated that almost all participants preferred the inclusion of seamlessly integrated evaluation above standard post-game evaluation.

In *KM Quest*, a game dedicated to teaching players about knowledge management (Leemkuil & de Jong, 2012), advice about their playing style was available to these players in an adaptive fashion, namely only when they did not perform well. Access to advice messages was voluntary; evaluation of KM Quest showed that advice was not always consulted when available, but also that the adaptive advice did not contribute to significantly higher learning scores. However, elaborative feedback on why certain actions in the game had particular outcomes was accessible to players. Leemkuil and de Jong found that players who accessed this information did have significantly higher learning outcomes, indicating that process feedback may be more important than short advice messages.

Our work on meta-techniques approaches parts of the research mentioned above from a different paradigm, namely that of live action role play. In this paper, we show how evaluation and feedback can be integrated in LOITER in a semi-seamless way, but still so that it stimulates 'deep' learning through reflection.

3. Meta-techniques in live action role play

Live action role play (larp) is a form of role playing in which participants physically enact their character roles. Especially in the Nordic countries of Europe, this form of role playing has a large following and the Nordic larp tradition has taken on a multitude of forms (Belarbi et al., 2010). These varieties of larp range from simulations in which every player tries to strictly stay in character to larps that are controlled by a director who can instruct characters to behave in certain ways during the play. In the latter, the distinction between the story world and the meta-story world is exploited to let the director influence how the play turns out. This is an example of a *meta-technique*: larpers (players of a larp) communicate information between each other that would not have been available to them in character. Meta-techniques can thus be used in larp as a communication channel to direct players, but also to enrich the story and characters' backgrounds, for example through flashbacks or inner monologues. In Table 1, we list several meta-techniques taken from larps.

Table 1: A list of meta-techniques and their uses in larp (adapted from Linssen et al. (2013)).

Meta-technique	Explanation
Black box	An area that is shielded from a larp's common role-playing space, and which can be used by players to use various meta-techniques in a nonintrusive manner, that is, without disturbing others' play. The black box is mostly used to enact scenes that do not fit into the larp's time/space continuum, for example flashbacks.
Flashback and flash-forward	Flashbacks may be used by players to enact scenes that happened in the past (before the larp's time frame) or may happen in the future.
Inner monologue	Players speak out their characters' inner thoughts aloud for other players to hear. This also gives insight into characters' motivations.
Act break	It may be agreed upon by larpers to break the larp into several acts. In between these acts, act breaks can be used to let players discuss the events that occurred during the previous act and how things may or should turn out during the next.
Meta hour	Similar to act breaks, the meta hour is a meta-technique during which the activity in the larp is paused. Then, scenes that took place during the larp can be re-enacted in isolation so that all players can witness these events.
Run-time game mastering	A larp may include players that do not act out character roles but instead direct or 'master' the larp. This can happen in a variety of ways, for example by 'shadowing' players and acting as their inner voice, speaking aloud the players' thoughts so that they must act accordingly. Gmasters may also manipulate the environment or even the player directly, for instance by shifting around objects in the world or by steering a player toward a relevant position in the world.

4. Learning in LOITER

Based on an analysis of the law enforcement domain, we are designing scenarios for LOITER. These scenarios involve loitering juveniles who are hanging around and causing a nuisance by playing loud music and by insulting passers-by. We have chosen this setting because it allows for a range of different possible conflicts between the police officer (the player) and the juveniles (virtual characters). Figure 1 shows two mock-up virtual environments which we are currently using for prototypes of LOITER.

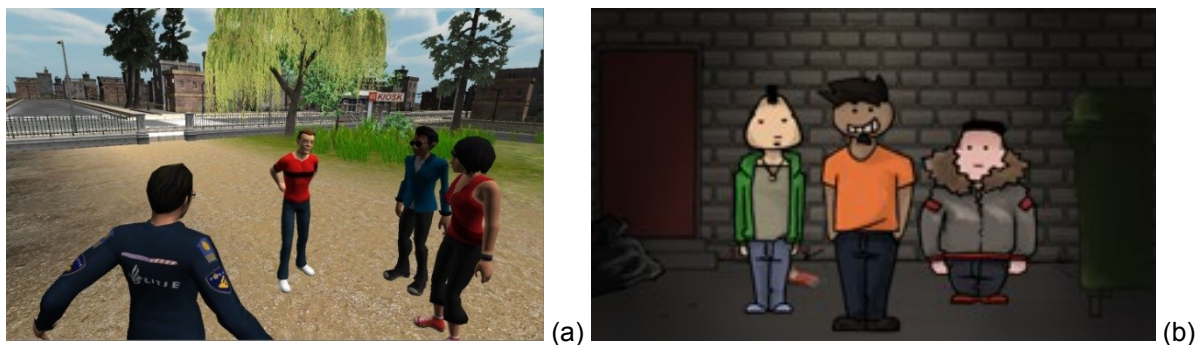


Figure 1: (a) A screenshot of a mock-up 3D environment showing a police officer interacting with a loitering juvenile and two of his friends; (b) A screenshot of a mock-up 2D environment with several loitering juveniles.

4.1. The interpersonal circumplex

To gain insight in street interventions, we have gathered domain information from several institutions and persons affiliated with the Dutch police. To inform the behaviour of the virtual juveniles, we also need to understand their thought processes underlying the behaviour. We conducted an analysis of enacted police interviews in which we linked theories from social psychology to observed behaviour (Bruijnes et al., 2014). One of the important theories that came to light in this analysis is that of stance (Leary, 1957). The concept of stance relates to interpersonal behaviours by classifying attitudes people have toward each other in the *interpersonal circumplex*, see Figure 2. For the behaviour of our virtual juveniles, we use a mental model that is being developed based on the work of Bruijnes et al. as we believe its observations can be generalised to our domain.

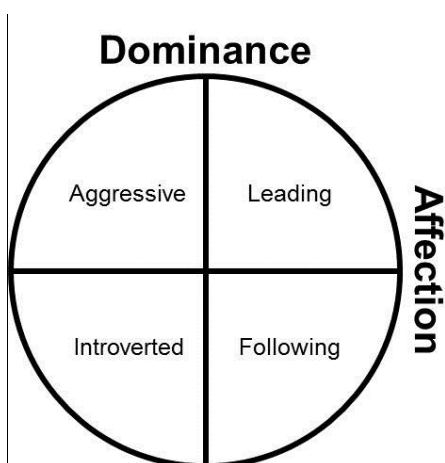


Figure 2: The interpersonal circumplex, showing adjectives corresponding to different stances along the dimensions of dominance and affection.

4.2 Learning goals

In the training curriculum of Dutch police trainees, there is no strict procedure for street intervention that officers should have mastered. There are no clear, context-independent rules for interactions with civilians, such as calling for back-up when a situation gets violent. Instead, there is only a global guide line for police officers, namely to try to resolve situations on the street peacefully and to de-escalate possible conflicts. To overcome this lack of explicit learning goals, we created a hierarchy of learning goals based on Krathwohl's revision of Bloom's Taxonomy of Learning Objectives (Krathwohl, 2002). This Taxonomy Table categorises learning goals along the two dimensions of knowledge and cognitive processes. The knowledge dimension consists of factual, conceptual, procedural, and

metacognitive knowledge; the cognitive process dimension consists of remembering, understanding, applying, analysing, evaluating, and creating.

We decided to take the concept of stance as the overarching theory in terms of which to express our learning goals. We did so because it captures the essentials of interpersonal interactions and we are able to explain the important factors of different attitudes and willingness to cooperate with this theory. Nonetheless, we consider creating learning goals related to other relevant theories about social interaction for future iterations of our serious game prototype. For the concept of stance, there are three tiers of learning goals trainees need to master, see Table 1. Firstly, trainees need to be able to recognise and classify behaviour in terms of stances and be able to express a stance in behaviour. Secondly, they need to be able to describe how their own stance triggers the other person to adopt a certain stance. Trainees also need to be able to use this knowledge to their advantage by assuming a stance that triggers another person to behave according to a stance the trainee desires. Thirdly, trainees need to be able to break down and criticise an interaction. In Table 2, we show how the created sets of learning goals; in Table 3, we show the classification of the learning goals in the Taxonomy Table.

Table 2: The three tiers of learning goals for LOITER.

Tier		Learning goal
1	A	Describe stances in terms of dominance and affect
	B	Describe stances in terms of the corresponding behaviour
	C	Recognise and classify behaviour in terms of stances
	D	Perform behaviour that conveys a stance
2	A	Describe relations between stances
	B	Determine why an action evokes a particular response
	C	Know which stance to assume to invite a person to behave in a desired way
	D	Express a stance to invite a person to behave in a desired way
3	A	Break down an interaction by determining points in time at which the stance of their interaction partner changed
	B	Criticise the approach they took in an interaction by explaining their choices, reflecting on it and indicating what they could have done better

Table 3: Taxonomy Table of learning goals for LOITER.

Knowledge/Cognition	Remember	Understand	Apply	Analyse	Evaluate	Create
Factual						
Conceptual	1A, 2A	1B, 1C, 2B	1D			
Procedural	2C		2D	3A		
Metacognitive					3B	

As shown in Table 3, the first tier of learning goals focuses on the conceptual ideas behind the theory of stance. The second tier of learning goals builds on this by introducing learning goals 2C and 2D that focus on procedural aspects of stance. Finally, in the third tier of learning goals, players need to analyse and evaluate their own behaviour, thus reflecting on their own approach and stimulating deep learning.

In the following section, we outline how we will incorporate the above learning goals by using implementations of meta-techniques in LOITER.

5. Learning goals and meta-techniques in LOITER

Larps can focus on simulating a certain setting as realistically as possible, but they can also introduce mechanics such as meta-techniques that go beyond strict simulation. The same can be said of serious games, which may also focus on strict realism or try to convey their message through less realistic or metaphoric approaches to a domain about which trainees have to learn. We agree with Richards and Szilas's point of view when they ask and answer in the negative: "Do [...] non-realistic but believable characters need to evolve in a functionally realistic environment to achieve the pedagogical goals of the virtual world?" (2012: 4). Moreover, we assert that, by using meta-techniques, the learning goals can be attained by LOITER's players more easily than without such techniques. For LOITER, we are developing implementations of two meta-techniques in more detail to provide feedback to players to attain the learning goals of the game. One of them is based on the act break meta-technique, the other is inspired by the inner monologue technique.

5.1 Act breaks in LOITER

As Lane and Rollnicks note in their study on communication skills training in the medical domain (2007: 13): "simulated patients [actors] can also be trained to provide feedback to trainees, and can assist with the teaching and facilitation of a teaching session." This is also true of the law enforcement domain, when police trainees enact scenarios with actors and discuss them afterwards. Therefore, the first meta-technique we wish to translate from its analogue form to a digitalised version is that of the act break. The minimal implementation of this meta-technique closely corresponds to how police trainees train with actors in real life: they act out the complete interaction and afterwards enter a discussion about what happened for what reason. Through this discussion, trainees receive feedback on their behaviour and are able to reflect and learn on their experience. In LOITER, players will assume the role of a police officer and try to resolve a possible conflict with a virtual loitering juvenile. Afterwards, players are able to discuss their own behaviour and that of the juvenile on a meta-level. This discussion takes place inside the game, but outside the story world, and lets players receive feedback on what has happened. We structure the act break so that the character and the player alternate between asking questions and giving answers to each other. These questions should directly relate to the learning goals that have been set up for the interaction. For example, for the tier 1 learning goals (see Table 1), the questions in the act break are concerned with descriptions and classifications of the behaviour in terms of stance.

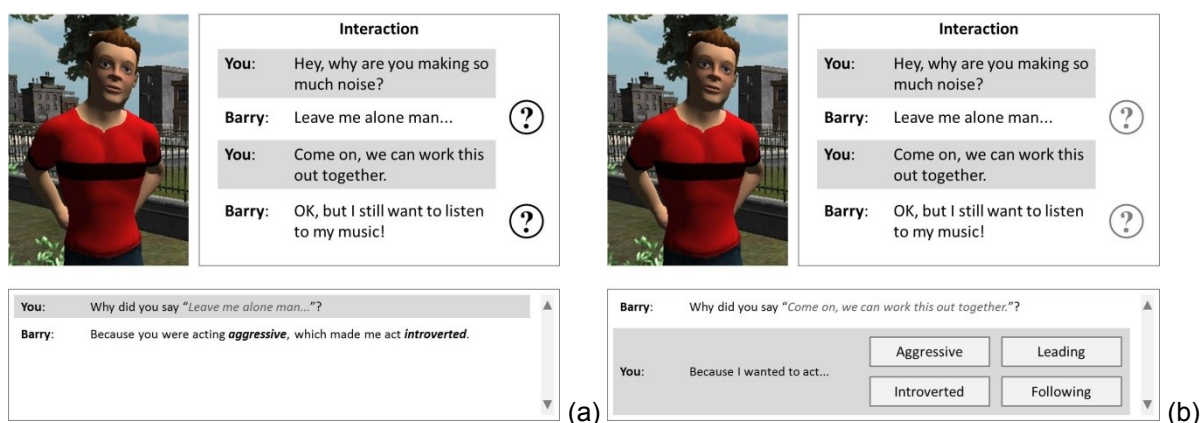


Figure 3: Mock-ups of a discussion between the virtual juvenile and the player during an act break. The upper part of the mock-up shows a trace of the gameplay, the bottom part shows an area for the discussion during the act break. In (a), the player asks a question to the juvenile; in (b), the juvenile asks a multiple choice question to the player.

In Figure 3, we show mock-ups of a possible interface for act breaks in LOITER (during interaction with the virtual characters in the story world, players play through a different interface not shown here).

Visible in this interface are the portrait of the juvenile the player interacted with, a trace of a simple story which shows actions that were performed by both parties, and part of a discussion that took place between the player and the virtual juvenile during the act break. The interaction during the act break goes as follows. First, the trace of the story is shown, after which the juvenile asks the player about which action he has a question. The player then selects one of the juvenile's actions from the story trace and asks him why he did this action by clicking on the question mark next to the juvenile's utterance. In Figure 3a, the player has just asked the juvenile character, why he responded this way to the player's action. This serves learning goal 2B, which encompasses that the player should be able to determine causal relations between actions and responses. The juvenile character will recall from its memory why it behaved that way, using its mental model to explain this in terms of stance. Figure 3b is an example of the virtual juvenile asking a question to the player. In this case, the character asks which stance the player wanted to assume, which relates to learning goal 1D, teaching the player how to behave to express a certain stance. The player can answer in a multiple-choice fashion, choosing one of the four stances of the interpersonal circumplex.

These questions can already let players reflect on their actions, but feedback on the answers of the questions is of course important to strengthen this process. For example, when the player answers the question of Figure 3b, the juvenile should say whether the intended stance of the player corresponds to the juvenile's interpretation of the player's behaviour. If the player meant to act 'leading' (see Figure 2), but the juvenile saw this action (according to his mental model) as 'aggressive', then the feedback should be that the player's action was less affectionate than he intended. Similarly, when the juvenile answers a question of the player (as in Figure 3a) and the player does not fully understand the reasoning behind the answer, he should be able to ask a follow-up question, indicating that he requires a more detailed explanation. Then, the juvenile character may, for example, give more detailed information about its mental model.

Staying true to the name of act breaks, we wish to structure the game so that there are multiple acts between which act breaks can provide necessary feedback to players. As the tiers of learning goals build on each other, the obvious choice is to have three acts corresponding to these three tiers, see Figure 4. Each act can then focus on different aspects of behaviour, going from simple to more complex types of interactions, thereby increasing the difficulty of the game over time. In this manner, the player can, together with the virtual juvenile, work through a set of questions that relate to the learning goals of the game in order to attain them. We are still considering whether to let the three acts feature successive interactions with one juvenile, building a relation between the player and this juvenile, or whether to feature three interactions with different juveniles.

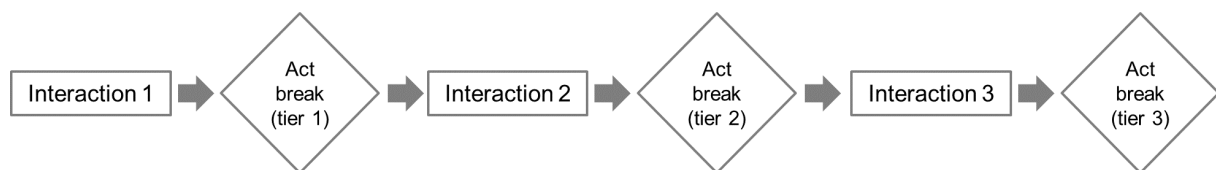


Figure 4: A schematic overview of the structure of the narrative of LOITER: act breaks take place in between interactions so that they function as moments for reflection and feedback to players.

5.2. Thought bubbles in LOITER

In Section 2, we described how various systems provided feedback to players in different ways. Our approach to integrating act breaks into LOITER is somewhat similar to that of the Global Handwashing Day game that tried to completely integrate evaluation into the game's story (Molnar & Kostova, 2013). With the act breaks, we try to integrate moments for reflection and feedback so that they fit into the game's flow, but still, this approach interrupts the flow of the story, as Figure 4 shows. Therefore, we also propose a meta-technique that provides feedback in a way that is less intrusive on the game's story, namely the inner monologue meta-technique. In larp, this technique requires larpers to actively

voice their thoughts during a play, which usually requires the rest of the play to be paused. For LOITER, we will implement this technique in the form of *thought bubbles*: a graphic convention often used in comics to portray characters' thoughts in the form of cloud-like bubbles above their heads. In our game, these bubbles can be shown in a similar manner, indicating how the characters feel about certain events and thereby giving both insight into their thoughts and feedback about the player's actions. In Figure 5, we show mock-ups of thought bubbles of a virtual juvenile.



Figure 5: Mock-ups of thought bubbles that express a juvenile's thoughts during the game. In (a), he thinks about his own stance; in (b), about the player's stance; and in (c) he indicates how the player's stance led to the juvenile's stance.

As explained above, we intend this use of a meta-technique to be less intrusive to the flow of the story than act breaks, while still assisting the player in attaining his or her learning goals. Therefore, instead of the textual descriptions used during the act breaks, we use a pictorial language that can express concepts related to our learning goals, in this case, stances. This simple language should be designed so that it is easy and quick to read. In this way, when thought bubbles are presented, they should provide enough feedback to players while not distracting them from the game's story for too long. We are currently considering creating figures based on the Self-Assessment Manikin (Bradley & Lang, 1994) to show how dominant and affectionate a character is, but for the mock-ups in Figure 5 we used other symbols. In Figure 5a we show a mock-up of the juvenile showing his thoughts about his own stance, indicated by an abstract picture of himself and a symbol that expresses his stance (following, peaceful). Figure 5b shows the juvenile's thoughts about the police officer's stance (aggressive) and Figure 5c shows his thoughts about the causal relation between the stances of the two characters. Here, it is made clear that the juvenile became 'following' because the police officer was aggressive. Thus, thought bubbles may be used to assist players in attaining learning goals from all three tiers.

6. Conclusion

To provide feedback to players of a serious game called LOITER, which focuses on improving social awareness of police officers, we look at meta-techniques used in live action role play. These techniques can provide insight into characters' motivations and feelings. In our game, players have to interact with loitering juveniles and try to resolve conflicts with them. Based on a set of learning goals we created for this domain, we are currently developing two implementations of such meta-techniques, namely the act break and inner voice techniques. During act breaks, players are able to ask questions to the character they interacted with in order to understand what drove them, in terms of the theories we wish to learn to players. The envisioned implementation of the inner voice meta-technique hinges on the use of thought bubbles that shows, using a simple pictorial language, what a virtual character thinks, again in terms of the theories players have to learn. Using these meta-techniques, we hypothesise that players of LOITER can more easily attain the learning goals we set out. Thus, in future work, we will implement and evaluate our approach.

Thus far, we have only looked at two meta-techniques from larp. Future research should focus on the expansion of our approach and investigate which other meta-techniques may be useful for serious games. Another possibility we envision is the use of meta-techniques to let the game adapt its behaviour automatically based on players' progress. This can take several forms, for example, based on feedback during an act break, the game may infer that it may be useful for the player to play through a similar interaction, as he or she did not attain all of his or her learning goals. Alternatively, we see possibilities in letting characters adapt their behaviour during gameplay, based on whether or not players take the appropriate actions.

Acknowledgements

This publication was supported by the Dutch national program COMMIT.

References

- Arnab, S. et al. (2014) "Mapping Learning and Game Mechanics for Serious Games Analysis", *British Journal of Educational Technology*, [online], Wiley Online Library, available from <http://www.wiley.com>. [Accessed: 28th January 2014.]
- Stenros, J. and Montola, M. (eds.) (2010) *Nordic Larp*, Feå Livia, Stockholm.
- Bradley, M. and Lang, P. (1994). "Measuring Emotion: The Self-assessment Manikin and the Semantic Differential", *Journal of Behavior Therapy and Experimental Psychiatry*, Vol 25, No.1, pp 49–59.
- Bruijnes, M. et al. (2014) "Social Behaviour in Police Interviews: Relating Data to Theories", in Poggi, I., Vincze, L., & Vinciarelli, A. (eds.) *Conflict and Negotiation: Social Research and Machine Intelligence*, Springer, Berlin. [In press.]
- Krathwohl, D. (2002) "A Revision of Bloom's Taxonomy: An Overview", *Theory into Practice*, Vol. 41, No. 4, pp 212–218.
- Lane, C. and Rollnick, S. (2007) "The Use of Simulated Patients and Role-play in Communication Skills Training: A Review of the Literature to August 2005", *Patient Education and Counseling*, Vol. 67, No. 1–2, pp 13–20.
- Leary, T. (1957). *Interpersonal Diagnosis of Personality: Functional Theory and Methodology for Personality Evaluation*, Ronald Press, New York, NY.
- Leemkuil, H. and de Jong, T. (2012) "Adaptive Advice in Learning with a Computer-based Knowledge Management Simulation Game", *Academy of Management Learning & Education*, Vol. 11, No. 4, pp 653–665.
- Linssen, J., Theune, M. and de Groot, T. (2013) "What Is at Play? Meta-techniques in Serious Games and Their Effects on Social Believability and Learning", in *Proceedings of the Social Believability in Games Workshop*. [online], available from <https://sites.google.com/site/socialbelievabilityingames/>. [Accessed: 1st December 2013.]
- Molnar, A. and Kostova, P. (2013) "Seamless Evaluation Integration into IDS Educational Games", in *Proceedings of the International Conference on Foundations of Digital Games*, [online], pp 322–329. Available from <http://fdg2013.org/program/papers.html>. [Accessed: 28th April 2014.]
- Richards, D. and Szilas, N. (2012) "Challenging Reality Using Techniques from Interactive Drama to Support Social Simulations in Virtual Worlds", in *Proceedings of the 8th Australasian Conference on Interactive Entertainment: Playing the System*, [online], ACM Digital Library, available from <http://dl.acm.org>. [Accessed: 31st March 2014.]

van Staalduinen, J. and de Freitas, S. (2011) "A Game-Based Learning Framework: Linking Game Design and Learning", in Khine, M. (ed.), *Learning to Play: Exploring the Future of Education with Video Games*, Waterstones, London.

Traum, D. et al. (2005) "Fight, Flight, or Negotiate: Believable Strategies for Conversing under Crisis", in Panayiotopoulos, T. et al. (eds.), *Intelligent Virtual Agents 2005*, Springer, Berlin.

Wilson, K., Bedwell, W. and Lazzara, E. (2009) "Relationships between Game Attributes and Learning Outcomes: Review and Research Proposals", *Simulation & Gaming*, Vol. 40, No. 217, pp 217–66.

Wißner, M. et al. (2012) "Increasing Learners' Motivation through Pedagogical Agents: The Cast of Virtual Characters in the DynaLearn ILE", in Beer, M. et al. (eds.), *Agents for Educational Games and Simulations*. Springer, Berlin.